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ABSTRACT

This packet contains a unit on teaching about volcanoes. The following question is addressed: How do volcanoes affect human life? The unit covers approximately three weeks of instruction and strives to present volcanoes in an holistic form. The five subject areas of art, language arts, mathematics, science, and social studies are integrated into the unit. Students are introduced to volcanoes as geographic features that are able to alter the functions of societies in close proximity to volcanoes. Focus questions include: (1) How may science fiction present volcanoes? (2) What are the layers of the Earth? (3) How do plate tectonics affect volcanic activity? (4) What is the historical significance of the eruption of Mount Saint Helens, Mount Pelee, and Mount Pinatubo? (5) What ate the types of volcanoes? (6) How are lava types different from one volcano to another? (7) How can we model volcanoes before and after eruptions? (8) How are people informed of volcanic eruptions? (9) What role does persuasive speech play in communicating safety issues surrounding volcanic eruptions? (10) Why are people concerned about volcanic eruptions? (11) What effects do volcanoes have on the environment? (12) How can you obtain information concerning professions in the study of volcanoes? and (13) How can volcano information be shared with the general public? (SAH)

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Volcanoes

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How Do Volcanoes Affect Human Life?

Integrated Unit
Developed for fourth grade
Written by Rebecca Dayton,
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Fall 2000
Completed for EDUC 200

LC: A637

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Unit Overview

This unit addresses the following focus question: "How do volcanoes affect human life?" Covering approximately three weeks of instruction, the unit strives to present volcanoes in a holistic format. Integrated into the unit are four subject areas: Art, Language Arts, Mathematics, Science, and Social Studies. Students are introduced to volcanoes as geographic features that are able to alter the functions of societies in close proximity of volcanoes. Below are the focus questions for the unit; these are also presented by subject areas in the unit web.

1. How may science fiction present volcanoes?
2. What are the layers of the Earth?
3. How do plate tectonics affect volcanic activity?
4. What is the historical significance of the eruption of Mount St. Helens?
5. What is the historical significance of the eruption of Mount Pelee?
6. What is the historical significance of the eruption of Mount Pinatubo?
7. What are the types of volcanoes?
8. How are lava types different from one volcano to another?
9. How can we model volcanoes before and after eruptions?
10. How are people informed of volcanic eruptions?
11. What role does persuasive speech play in communicating safety issues surrounding volcanic eruptions?
12. Why are people concerned about the effects of volcanic eruptions?
13. What effects do volcanoes have on the environment?
14. How can you obtain information concerning professions related to volcanoes?
15. How can volcano information be shared with the general public?

How do volcanoes affect human life?

Language Arts

How may science fiction present volcanoes?

How are people informed of volcanic eruptions?

How can you obtain information concerning professions related to volcanoes?

How can volcano information be shared with the general public?

What role does persuasive speech play in communicating safety issues surrounding volcanic eruptions?

Mathematics

What statistical information is available about volcanoes and their eruptions?

Art

Science

What are the layers of the Earth?

How do plate tectonics affect volcanic activity?

How can we model volcanoes before and after eruptions?

What are the types of volcanoes?

How are lava types different from one volcano to another?

Social Studies

What effects do volcanoes have on the environment?

What is the historical significance of the eruption of Mount St. Helens?

What is the historical significance of the eruption of Mount Pelee?

What is the historical significance of the eruption of Mount Pinatubo?

Why are people concerned about the effects of volcanic eruptions?

Unit Rationale

Catastrophic events and natural disasters tend to pique the interest of school-aged children. One such natural disaster, volcanoes, serves as the focus of this integrated unit. Since students in West Virginia do no have direct access to volcanic information within their regional society, this unit will introduce them to volcanoes and their effects on human life. Through the general instruction processes and skills, along with content knowledge about volcanoes, the students are given a basis for future learning. Small-scale research, involving the gathering of data and the presentation of ideas, is a part of general academic skills that support educational success, both in fourth grade and in upper grades. As the students develop content knowledge surrounding volcanoes and their eruptions, they gain mental schemes for reacting appropriately to these natural disasters. Students will begin to identify why concern envelops volcanic eruptions and how they may personally respond to the benefit of society.

In order to design an integrated unit that is developmentally appropriate for students in the fourth grade, the authors believe that the unit's foremost alignment to the *West Virginia Instructional Goals and Objectives* has resulted in instructional approaches and content knowledge supportive of this developmental level. A list of the state standards is included at the conclusion of the rationale. The incorporation of art, language arts, mathematics, science, and social studies assists in addressing the holistic learning needs of students. By implementing approaches that support growth towards independent learning, the authors realize how fourth grade students are beginning to experience methods of instruction that allow for greater individual direction. While working in small groups of peers and receiving guidance from the instructor, the students will be encouraged to develop good learning habits that are applicable beyond this unit on volcanoes. Since a portion of the unit is directed by the students and their decisions, made either individually or in small groups, the children are given the opportunity to practice decision-making processes on a developmentally appropriate level.

During the three weeks of instruction, the students will encounter various ways by which volcanoes affect human life. The science lessons provide the necessary background information for understanding volcanoes and their eruptions. Social studies' instruction presents multiple examples of past volcanic eruptions and the respective effects on society. In the language arts sector of the unit, the students encounter ways by which people communicate concerning the natural disaster of volcanic eruptions. The activities linked to art allow the students to interact in a hands-on manner with the subject material presented in the other content areas.

Overall, the unit on volcanoes and their effects on human life is intended to provide a holistic learning opportunity for all students. The students are able to experience aspects

of the natural disaster that extend beyond the daily experiences available within their region. The content knowledge, process skills, and attitudinal aspects addressed in this unit are applicable to additional academic learning and also to the students' growth towards being responsible and aware citizens.

Background Information

Volcanoes erupt, releasing energy and destroying the stability of affected areas. What controls these natural disasters? How do they ultimately affect human civilizations? These two questions are central to this integrated unit on volcanoes. By developing an understanding of volcanism, the realization and reflection of how societies respond and are affect are built upon this clearer notion of volcanoes.

Volcanoes are a result of the structural features of the Earth. Earth is composed of three distinct layers. From the outermost layer to the inner division, these are the crust, mantle, and core. The core can be further subdivided into the outer and inner cores. Both of the cores are composed mainly of the metallic elements of iron and nickel; the inner core is solid, while the outer section is molten. The mantle comprises the largest percentage of the Earth's interior and is neither completely solid nor liquid. In accordance with this composition, the mantle allows for some fluid motion. Finally, the crust is the relatively thin outer layer of the planet. Broken into larger sections, called plates, the crust rests on and moves with the partially melted mantle (Frank, et al., 2000).

The movements of the crust and mantle are included in the theory of plate tectonics. This scientific theory serves as the beginning for understanding the phenomena of volcanism. Referred to as the unifying principle of geology, plate tectonics is initially linked to Alfred Wegener. First publishing his ideas on continental drift in 1912, Wegener is faulted for not including a mechanism for this motion. Further geologic investigations have since lead to the idea of plate tectonics, that the crust is composed of plates that move on the plastic-like layer of the mantle. Convection currents may be the source of energy driving the movement of the plates (Renton, 1994).

As the plates of the Earth's crust move, three plate boundaries occur. When two plates move away from each other, the boundary is labeled as divergent. Convergent boundaries exist when plates move towards each other. The final type of plate boundary results in transform faults, with the involved plates sliding past each other. Most volcanism is associated with plate boundaries. While the majority of volcanic activity occurs at divergent boundaries, this volcanism is contained beneath the surface of oceans. Here, new oceanic crust is created. Observable volcanoes are mainly situated along

convergent plate boundaries. Volcanoes are also located within plate boundaries; this results from the presence of deep magma chambers located in the mantle (Renton, 1994).

All volcanoes originate from the upwelling of molten rock towards the Earth's surface. When contained within the Earth, this molten rock is called magma, but at the surface, this same material is referred to as lava. The eruption of molten rock results in the formation of cone-shaped mountains, volcanoes. Also involved in the creation of volcanoes are the ash and volcanic rocks ejected in the eruption (Aldridge, et al., 1998).

Volcanoes can be labeled as active, dormant, or extinct. Active volcanoes are usually those that experience frequent or recent eruptions. While not presently erupting, dormant volcanoes have erupted and are considered to erupt again in the future. Extinct volcanoes, however, are neither erupting nor likely to erupt (Renton, 1994).

Volcanoes are further classified based on both conical structures and eruptive intensity. Four general shapes describe the range of volcanoes: cinder cone, splatter cones, shield volcanoes, and composite volcanoes. Cinder cones are relatively small in stature, seldom reaching more than 1,000 feet above the land surface. Composed mainly of cinder-sized materials, such as minerals and rocks ejected during eruptions, these volcanoes usually contain craters at their summits. Similarly, splatter cones do not obtain great heights, being formed by repetitive emission of magma at low pressures (Renton, 1994).

The third type of volcano based on structure is the shield volcano. The low viscosity of the lava associated with shield volcanoes allows the molten material to flow far from the central vents, resulting in broad based and gently sloped cones. The Hawaiian Islands are notable examples of this type of conical structure. The final volcanic cone shape is the composite volcano. Herein, the combination of viscous lava and coarse solids results in steep cones of great heights. Most of the well-known volcanoes are of this type; Mount St. Helens is such a volcano (Renton, 1994).

Volcanoes can also be classified based on their eruptive intensities. The intensity of an eruption is dependent upon two criteria: gas content and lava viscosity. When magmas contain low levels of gases, then eruptions are relatively quiet; similarly, low viscosity lavas are also associated with more gentle volcanic explosions. Five categories divide volcanoes according to their volcanic intensities. From comparatively quiet to violently explosive, the categories are Hawaiian, Strombolian, Vulcanian, Pelean, and Plinian (Renton, 1994).

Closely associated with volcanic intensities are the materials ejected during eruptions. In general, gases, liquids, and solids are all expelled during volcanic eruptions. Gases released mainly consist of water vapor, sulfur dioxide, and carbon dioxide. As for liquids, most lava is basaltic. These basaltic lavas are of relatively low viscosity and move easily to the Earth's surface. Solid fragments that are expelled during volcanic eruptions are termed tephra or pyroclastics. Tephra includes the broken pieces of minerals and rocks, along with solidified magma, that are released by volcanoes. Ash and dust are also listed under the solid materials ejected during volcanic eruptions (Renton, 1994).

These ejected materials are the main cause for both environmental and societal concerns. The burning projectiles have the potential for starting fires, and pyroclastic flows and released gases can result in inhalation difficulties, such as asphyxia. Mud and lava flows may lead to the demolition of physical structures, while the eruptions themselves can cause local earthquakes and tidal waves. The ash and dust carried high into the atmosphere are capable of blocking the Sun's rays, thus disrupting the environmental balance that is based strongly on photosynthesis (The Caribbean Disaster Emergency Response Agency [CDERA], 2000).

As civilizations consider the hazards of volcanic eruptions, historical eruptions serve as examples of possible results and the consequent reactions. For example, Mount St. Helens, located in the northwestern parts of the continental United States, is known for its eruption on May 18, 1980. After a dormant period of 123 years, Mount St. Helens began to show signs of a possible eruption. As with most volcanic eruptions, this one presented prior warnings through increased seismic activity and surface bulges. The main eruption released a plume 15 miles high. An area extending 12 miles from the volcano was destroyed, and at least 60 fatalities resulted from this explosion (Renton, 1994).

In reaction to the potential damage and destruction that volcanic eruptions bring, societies that exist within volcanic territories create emergency action plans for dealing with these natural disasters. Preparation begins with monitoring the volcanoes and maintaining communication between responding organizations and with the media and the public. Daily, volcanoes are tracked for measurable changes in seismic activity, ground deformation, or other physical and chemical aspects (Mount Rainer, 2000). Volcano bulletins present the status of volcanoes. The levels of normal, abnormal, alarming, critical, eruption imminent, and eruptive indicate the increasing need for the evacuation of the area and the implementation of the emergency plans (CDERA, 2000). Communication of ground and ash hazards is intended to prevent losses of life by allowing for timely evacuations.

Current advancements in understanding volcanoes results from both the people involved in this scientific domain and technology. Scientists who study volcanoes, field geology technicians, and seismologists are examples of professions directly linked to the natural phenomena of volcanoes. Aided by technology, such as robotic explorers, these professions seek to understand volcanoes. By developing clearer understanding about the causes of volcanoes and their effects, then steps can be taken to help reduce the effects volcanic eruptions have on the stability of society.

Unit Objectives

Knowledge Objectives

- Students will listen to a science fiction story set on the morning of the Mount St. Helens' eruption.
- Students will draw and label a diagram of the Earth's layers.
- Students will write brief explanations of what happens at locations of plate boundaries.
- Students will research Mount St. Helens and create small posters of their research findings.
- Students will research Mount Pelee and create small posters of their research findings.
- Students will research Mount Pinatubo and create small posters of their research findings.
- Students will match volcano pictures with volcano types.
- Students will experiment with viscosity related to different volcano types.
- Students will construct two models of volcanoes, one before and the second after eruptions.
- Students will write news articles about historical eruptions.
- Students will prepare and present persuasive speeches concerning volcano evacuations.
- Students will write one-page papers, analyzing why people are concerned about volcanic eruptions.
- Students will write one-page papers in which they identify and analyze five environmental effects of volcanoes.
- Students will write interview questions for learning more about professions related to volcanoes.
- Students will create a class newsletter, presenting an overview of the volcano unit.

Skill Objectives

- Students will gather data.
- Students will organize information into charts and essays.
- Students will express ideas in written forms.

Attitudinal Objectives

- Students will express their thoughts about volcanoes.
- Students will identify and experience the effects of persuasive speech.
- Students will identify why people are concerned about volcanic eruptions.

***West Virginia Instructional Goals and Objectives* for the fourth grade**

Language Arts

4.5 given a narrative, distinguish between factual information and information based on opinion.
4.8 given a narrative, paraphrase, summarize, and ask appropriate questions regarding content.
4.13 contribute to group discussions.
4.17 make an oral presentation using appropriate volume, pitch, and rate of speech.
4.19 read literary works by national and international authors to include, but not limited to: legends, folktales, biographies, historical fiction, and WV authors.
4.46 identify and use content area vocabulary given a variety of reading material.
4.49 use the writing process across the curriculum.
4.50 develop various types of writing including, but not limited to, narrative, informative, and persuasive.
4.53 produce a composition with a main idea and specific, relevant details.
4.79 identify purpose of various types of paragraphs.
4.81 identify appropriate reference sources for specific information.
4.83 identify and use sources of different types of information.
4.95 using a word processor, create a one or more paragraph document.
4.101 using a word processor, input types of writing such as paragraphs, stories, letters, and newspaper articles.

Mathematics

4.26 understand and reason about the use and misuse of statistics in our society.

Science

4.3 design a model given a set of attributes.

4.5 probe deeply into natural phenomena by asking and answering questions about the environment.

4.7 realize that science is never finished by observing changes in the environment.

4.11 be in awe and wonder of the patterns, variations, and interactions of objects in the universe.

4.13 listen to and be tolerant of different viewpoints by engaging in collaborative activities and modifying ideas when new and valid information is presented.

4.27 engage in active inquiries, investigations, and hands-on activities for a minimum of 50% of the instructional time to develop conceptual understanding and laboratory skills.

4.32 establish connections across the curriculum.

4.33 compare, sort, and group objects according to buoyancy, magnetic properties, states of matter, density, solubility, conductivity and ability to react - systems

4.67 investigate the cause and effects of volcanoes, earthquakes, and landslides.

Social Studies

4.28 use geographic terms to describe America's physical features.

4.43 utilize map skills to locate places and to construct maps.

4.45 construct and use charts, graphs, tables, and grids to display data.

4.46 analyze and interpret information from pictures and news sources related to historical events and people.

4.47 suggest appropriate reference sources to answer specific questions, collect information, and prepare short reports

Lessons Listed by Subject*

Language Arts

- A Science Fiction Introduction to Mount St. Helens and Volcanoes
- News Articles and Historical Eruptions
- Persuasive Speeches and Volcano Evacuations
- Preparing Interviews for Professionals in the Field of Volcanoes
- Class Newsletter

Science

- Layers of the Earth
- Plate Boundaries
- Types of Volcanoes
- Building Volcano Models
- Viscosity of Lava

Social Studies
- Environmental factors
- The Mount Pelée Eruption
- The Mount St. Helen's Eruption
- The Mount Pinatubo Eruption
- Public Concerns

Mathematics
- Public Concerns

Art
- Building Volcano Models
- Class Newsletter

***Although this is our list of lessons by subject, we suggest that these lessons be taught in the order that they are presented in this unit from this point forward.**

Lesson Title: A Science Fiction Introduction to Mount St. Helens and Volcanoes

Objectives: Students will listen to a science fiction story set on the morning of the Mount St. Helens eruption.
Students will distinguish between facts and information-based opinions included in the story.
Students will participate in a grand conversation about the story.
Students will complete a KWL chart for volcanoes.

IGOs: 4.5 given a narrative, distinguish between factual information and information based on opinion.
4.8 given a narrative, paraphrase, summarize, and ask appropriate questions regarding content.
4.13 contribute to group discussions.
4.19 read literary works by national and international authors to include, but not limited to: legends, folktales, biographies, historical fiction, and WV authors.

Materials: The Volcano Disaster (written by Peg Kehret and Samuel Beckoff)
KWL chart

Procedure/Assessment: In this lesson, the students will interact with a science fiction story based on the 1980 eruption of Mount St. Helens. The story will serve as an introduction into the volcano unit. After listening to a read aloud of the story, the students will discuss the main plot and present their personal reactions to Warren Spalding's teleport experience. In the grand conversation, students will also separate the factual information from the opinions presented in the story. In completing the KWL chart, students will have a visual representation of what they know (K) about volcanoes and the eruption of Mount St. Helens, what they want (W) to know, and, at the conclusion of the unit, what they have learned (L). As part of the formal unit assessment, students will answer the following question: In The Volcano Disaster, Warren Spalding is teleported back to the morning of the eruption of which volcano? A. Mount St. Helens, B. Mount Pelee, C. Mount Rainer, or D. Mount Santorini.

Lesson Title: Layers of the Earth
By Carrie E. Edwards

Objectives: Students will draw and label a diagram of the Earth's layers
Students will explain the differences between layers of the Earth

IGOs: 4.67 investigate the cause and effects of volcanoes, earthquakes, and landslides – changes

Materials: one paper towel per student, one boiled egg per two students (each student needs one half of the boiled egg, shell intact), paper, pencil

Procedure/Assessment: To introduce the lesson, the teacher will ask students if they can name the layers of the earth. Students will offer responses which should include core, mantle, and crust. Each pair of students will be given one boiled egg. The teacher will ask students to get out a piece of paper and fold it in half so students have two equal sections. On the first half of the paper, students should draw a prediction of what they think the inside of the egg looks like. Once predictions are made and drawn, the teacher will cut each egg in half and explain to students that the inside of the egg when cut in half is a good representation of what the inside of the Earth would look like if we could cut it in half. Each student should draw and label their own diagram of the Earth's layers using the egg as a visual aid. Each layer will then be discussed in detail and a one sentence description of each layer will be added to the bottom of each student's diagram. Each layer will be compared to the others to better understand the differences between them.

Lesson Title: Plate Boundaries/Movements
By Carrie E. Edwards

Objectives: Students will write brief descriptions of what happens at locations of plate boundaries.

IGOs:
- 4.7 realize that science is never finished by observing changes in the environment
- 4.11 be in awe and wonder of the patterns, variations, and interactions of objects in the universe
- 4.27 engage in active inquiries, investigations, and hands-on activities for a minimum of 50% of the instructional time to develop conceptual understanding and laboratory skills
- 4.67 investigate the cause and effects of volcanoes, earthquakes, and landslides – changes

Materials: two pieces of card stock paper per student, one worksheet per student (see Appendix), pencils

Procedure/Assessment: To begin this lesson the teacher will ask a student volunteer to quickly review what the class learned the day before about the layers of the Earth. A student will review the layers, core, mantle, and crust, and discuss the differences between them. The teacher will ask specifically about the crust, "What did we learn about the crust?" The teacher will make sure students understand that the crust is the most fragile layer and that there are many plates moving within the crust which cause many interesting things to happen on the Earth's surface. Each student will be given two pieces of card stock paper (oak tag). They will be instructed to think about the different ways the paper can be moved in regards to one another. Students should move around their pieces of paper and experiment on their own with what can happen at plate boundaries. Once students have had several minutes to experiment, the teacher will ask what students noticed in regards to different movements and what happened at those areas of plate boundaries. Students should notice that plates (pieces of paper) can move away from one another causing areas of subduction zones. They should also notice when moving plates (paper) together, a mountain has been formed (the paper has peaked). Also, plates can move from side to side rubbing against one another causing friction and shaking just as earthquakes do. Students will draw each type of plate boundary and give a brief description on their worksheet.

Lesson Title: The Mount St. Helen's Eruption
By Michelle Sisler

Objectives: Students will use the Internet and other resources to research and find information about the history and eruption of Mount St. Helen.
Students will use the information that they researched to illustrate and create a one-dimensional model of Mount St. Helen before and after the eruption.
Students will list statistics that are pertinent to the eruption of Mount St. Helen.
Students will list at least 10 facts about the eruption of Mount St. Helen.

IGOs:
4.28 use geographic terms to describe America's physical features (e.g., mountains, rivers, grassland, and oasis)
4.43 utilize map skills to locate places and to construct maps (e.g., symbols in a legend/key; lines of demarcation.
4.45 construct and use charts, graphs, tables, and grids to display data.
4.46 analyze and interpret information from pictures and news sources related to historical events and people.
4.47 suggest appropriate reference sources to answer specific questions, collect information, and prepare short reports.

Materials: computers, paper, pencils, poster board, markers, encyclopedias, chalk, black board

Prodedure/Assessment: In this lesson, the students will research the eruption of Mount St. Helen's. They will do this by getting into groups of four and researching the topic on the Internet and in the class encyclopedias. Once they have collected enough information, the students will create a poster about Mount St. Helen's. This poster will include not less than ten facts about the volcano and it's eruption. It will also include a brief biography of the volcano and statistics related to the eruption will be displayed using a chart. The students will also locate the volcano on a map. On the poster, the students will also include a one-dimensional representation of the volcano before and after the eruption.

Lesson Title: The Mount Pelée Eruption
By Michelle Sisler

Objectives: Students will use the Internet and other resources to research and find information about the history and eruption of Mount Pelée.
Students will use the information that they researched to illustrate and create a one-dimensional model of Mount Pelée before and after the eruption.
Students will list statistics that are pertinent to the eruption of Mount Pelée.
Students will list at least 10 facts about the eruption of Mount Pelée.

IGOs: 4.46 analyze and interpret information from pictures and news sources related to historical events and people.
4.47 suggest appropriate reference sources to answer specific questions, collect information, and prepare short reports.

Materials: computers, paper, pencils, poster board, markers, encyclopedias, chalk, black board

Objectives	Procedures	Assessments
Students will become interested in learning more about the eruption of Mount Pelée.	**Introduction** The teacher will introduce the topic by asking the students if they have ever heard of the volcano, Mount Pelée. The teacher will briefly discuss the volcano with the students. She will write down, Mount Pelée, on the blackboard and will write down the following factual information underneath of the title. • All of the 30,000 residents of St Pierre were killed except two. • Erupted May 8, 1902. • Strato Volcano • Largest number of casualties for a volcano in the twentieth century.	Students will ask the teacher questions about the eruption of Mount Pelée.
Students will gain some knowledge about the eruption of	**Development** The teacher will tell the students that Mount Pelée erupted in 1902. Many of the residents were worried because the volcano showed signs of erupting before May 8. These residents chose to	Students will show interest in learning more about the eruption of Mount Pelée.

Mount Pelée, which will encourage them to write about the eruption.	leave the island. However, many of the residents chose to stay because there was an important election being held in the town and the residents wanted to support their candidates. The deaths of the residents were caused by the pyroclastic flow from the eruption. At this time little was known about pyroclastic flows. One of the only survivors of the eruption was a prisoner in an underground cell in the city.	
Students will critically think about what decisions people must make when confronted with a difficult, life or death decision. Students will work in groups to create a poster about Mount Pelée.	The teacher will ask the students what they think they would have done in a similar situation, if they lived at the base of a volcano that was showing signs of being active. Would they have stayed or would they have evacuated? The teacher will tell the students that they are going to research this eruption. Students will be grouped into groups of four. Pairs of students will be asked to work at a computer and to use the Internet to research the eruption of Mount Pelée.	Students will answer teacher's questions thoughtfully.
Students will work cooperatively and in an orderly manner to get into groups of four.	Students will be asked to get into groups of four.	Students will arrange themselves into groups of four.
Students will efficiently decide what each group member's responsibility will be.	Students will be asked to collaborate as a group and decide what responsibilities each group member will have.	Students will decide upon what responsibilities the students will have.
Students will use the Internet and other sources to	The students will work in their groups and will use the Internet to research the eruption of Mount Pelée. The students will also be asked to use encyclopedias	Students will use the Internet.

research Mount Pelée.	for additional information.	
	Application	
Students will be given information concerning research on the Internet.	Students will be given two days to complete this lesson. During the first day the students will work in their groups and use the Internet to research Mount Pelée. During the second day, the students will use the information that they found the day before, to create their poster. Tell the students to keep a list of all of the Internet sites that they take information from, because they will be referencing these sites in their poster. Tell them to not only look for historical and scientific information, but also for information that would interest other students in the class.	Students will pay attention to teacher as she gives instructions.
Students will use the Internet to research Mount Pelée.	The students will be given the better part of a forty-minute class period to research the eruption on the Internet. They will be asked to write down information that they need for the next day on a sheet of paper, so that it will be easily accessible.	Students will work in groups to research Mount Pelée on the Internet.
Students will create a poster using the information that they found on the Internet.	The students will be asked to create the poster on the second day. Before beginning the lesson, the teacher will write all of the following requirements on the board. Tell the students that the poster should be neat and should be creative. Tell the students that the poster should contain at least ten facts about the eruption. It should include a brief biography of the eruption. It should also contain information about what happened after the eruption. It should include statistics related to the effect of the volcano, as well as physical data about the volcano. The students will then draw before and after pictures of the volcano.	Students will actively work in their groups to create a poster.
Students will	The teacher will ask the students to	Students will

discuss their poster with the class.	discuss their posters with the class.	discuss their posters in great detail.

Formal/ final Assessment: The poster that the students create will be graded for historical accuracy, creativity, effort, and for adherence to the guidelines that the instructor wrote on the board.

Lesson Title: The Mount Pinatubo Eruption
By Michelle Sisler

Objectives: Students will use the Internet and other resources to research and find information about the history and eruption of Pinatubo.
Students will use the information that they researched to illustrate and create a one-dimensional model of Pinatubo before and after the eruption.
Students will list statistics that are pertinent to the eruption of Pinatubo.
Students will list at least 10 facts about the eruption of Pinatubo.

IGOs:
4.28 use geographic terms to describe America's physical features (e.g., mountains, rivers, grassland, and oasis)
4.43 utilize map skills to locate places and to construct maps (e.g., symbols in a legend/key; lines of demarcation.
4.45 construct and use charts, graphs, tables, and grids to display data.
4.46 analyze and interpret information from pictures and news sources related to historical events and people.
4.47 suggest appropriate reference sources to answer specific questions, collect information, and prepare short reports.

Materials: computers, paper, pencils, poster board, markers, encyclopedias, chalk, black board

Prodedure/Assessment: In order to do this lesson; the students will begin by researching the eruption of Pinatubo on the Internet and through the use of encyclopedias. The students will locate Pinatubo on a map, and will examine its location in relation to Mount St. Helen's and Mount Pelee. The students will create a poster that contains statistical information about the eruption in a chart or table. The poster will include a biography of the volcano and at least ten historical facts. The students will also include a drawing of the volcano before and after the eruption. Having the students present their posters to the class will end the lesson. The poster that the students create will be graded for historical accuracy, creativity, effort, and for adherence to the guidelines that the instructor wrote on the board.

Lesson Title: Types of Volcanoes
By Carrie E. Edwards

Objectives: Students will match volcano pictures with volcano types.

IGOs: 4.33 compare, sort, and group objects according to buoyancy, magnetic properties, states of matter, density, solubility, conductivity and ability to react- systems

Materials: pictures of various volcano types from books or the Internet, computers with Internet access and word processing program

Procedure/Assessment: The teacher will ask students if they know any particular volcano types and/or where volcanoes are found. Students will respond appropriately and teacher will add to student responses stressing shield volcanoes from Hawaii, dome volcanoes, stratovolcanoes, and cone volcanoes. Students will be divided into groups of four. Each member of the group will be assigned a volcano type to research using available books and the Internet. Once each student has researched enough to write a paragraph describing and giving examples of his/her volcano type, his/her group will compile their paragraphs into a small research paper to share with the rest of the class. These papers will be passed around the class to other groups and compared for similar research findings and differences. Each student can learn from what other groups have found.

Lesson Title: Viscosity of Lava
By Carrie Edwards

Objectives: Students will experiment with viscosity related to different volcano types.
Students will compare and group viscosity by less viscous and more viscous.
Students will relate viscosity levels to volcano types.

IGOs:
4.11 be in awe and wonder of the patterns, variations, and interactions of objects in the universe
4.13 listen to and be tolerant of different viewpoints by engaging in collaborative activities and modifying ideas when new and valid information is presented
4.32 establish connections across the curriculum (e.g., integrate science with mathematics, social studies, language arts, arts, and/or physical education)
4.33 compare, sort, and group objects according to buoyancy, magnetic properties, states of matter, density, solubility, conductivity and ability to react - systems

Materials: chalk, chalkboard, paper towels, five plastic plates per group, five sticky liquids (honey, maple syrup, chocolate syrup, dishwashing detergent, and shampoo), one timer (with minutes and seconds) per group (if a large clock with second-hand is not available in the classroom), one data sheet per individual student (see Appendix)

Objectives	Procedures	Assessments
	Introduction	
Students will recall volcano types to review from the last lesson.	The teacher will offer a brief review of volcano types as discussed in the previous lesson: dome, shield, cone, and stratovolcanoes, by asking students to recall four types of volcanoes and give a brief description of each type.	Students will answer questions regarding volcano types.
Students will recall differences between volcano types including lava differences	The teacher will ask students if they remember what made each type of volcano different from one another. Students should recall physical features, differences in formation, and lava differences within each type.	Students will respond to teacher questions and discussion about differences of volcano types.

	Development	
Students will define the word "viscosity."	The teacher will introduce the term "viscosity," referring to lava and will write this word on the board. He/she will ask the class, "What do you think this word means if we are talking about lava differences?" Students will offer answers to the question.	Students will offer possible definitions for the term "viscosity."
Students will write the correct definition of "viscosity" on their data sheet	The teacher will add to the definition of viscosity if necessary to be sure of student understanding. The complete definition will be written on the board and students are to write this definition in the proper place on their data sheet.	Students will correctly define the term "viscosity."
Students will describe liquids by viscosity.	The teacher will ask students to offer everyday substances that they believe to be very viscous (thick). Correct answers would include maple syrup, molasses, or motor oil. The teacher will ask students to offer everyday substances that are less viscous (thin and runny). Correct answers would include but not be limited to water or soda.	Students will identify types of liquids of different viscosity levels.
	Application	
Students will work cooperatively to complete the viscosity experiment.	The teacher will now have students get into six groups (3-5 members each depending upon class size). Once students are in groups, the teacher will introduce the activity by explaining to students by saying, "Today we are going to learn which substances have the greatest viscosity and which have the least viscosity in an experiment." Within your groups you are to have a timer, a materials specialist, and an experimenter. The timer is in charge of timing the length of time it takes for each substance to reach the edge of the plate. The	Students will work well as a group and will properly fulfill their position of timer, materials specialist, or experimenter.

	materials specialist is in charge of getting the group's materials and returning them once the experiment is complete. The job of the experimenter is to pour each liquid into the center of the plate.	
Students will write data on data sheet.	"Each group has been given five liquids and you will be comparing the thickness or viscosity of these substances by timing the amount of time it takes to move from the center to the edge of the plastic plate." Students should write the results (time) of each liquid on their data sheet (See Attached).	Students will keep accurate records on attached data sheet.
Students will transfer data to chalkboard and explain viscosity by time required to move.	Once this activity is completed and all student data sheets are filled out, the timer from each group will write on the chart drawn on the chalkboard (See Attached) their group's data. The class will discuss similarities at this time as well as which liquids moved fastest (were less viscous) and those that moved slowest (were more viscous).	Students will share and discuss data with the class.
Students will relate viscosity to types of volcanoes.	"If these liquids we used represented types of lava, which liquids would be in a Hawaiian shield volcano?" (quick spreading, low viscosity lava) "Which would be in a dome volcano?" (slow spreading, high viscosity lava).	Students will name the liquids that could be representative of lava in shield and dome volcanoes.
Students will share what they have learned with the class and teacher	To wrap-up the activity, the teacher will ask students what they learned during this lesson about viscosity. Students will respond and this will act as a review and an assessment.	Students will respond to teacher question with what was learned.

Formal/ final Assessment:

Students will be observed and evaluated during the class discussions and question and answer sessions. Cooperative group participation as well as fulfilling "job requirements" of timer, materials specialist, and experimenter will be

observed. Lastly, students will turn in data sheets from the experiment to be graded.

Lesson Title: Building Volcano Models
By Carrie E. Edwards

Objectives: Students will build two volcano models, one before and the second after an eruption.
Students will represent the physical impacts of a volcano eruption.

IGOs:
- 4.3 design a model given a set of attributes
- 4.13 listen to and be tolerant of different viewpoints by engaging in collaborative activities and modifying ideas when new and valid information is presented
- 4.27 engage in active inquiries, investigations, and hands-on activities for a minimum of 50% of the instructional time to develop conceptual understanding and laboratory skills
- 4.32 establish connections across the curriculum

Materials: baking soda, red food coloring, twelve 20 ounce soda bottles (empty and rinsed out with tops cut off), clay or play-doh, deep trays

Procedure/Assessment: The teacher will introduce the lesson by explaining to students that they will be working in small groups to construct their own volcanoes. The class will be divided evenly into six groups. Each group will be given a deep tray to work in, two soda bottles, and a fist full of clay or play-doh. Each group is to first use the clay and bottle to construct a volcano before it has erupted. They are then to picture what that volcano should look like after it has had a powerful eruption (the top should be blown away). After constructing their two volcanoes, the teacher will place a tablespoon of baking soda as well as a few drops of red food coloring in the bottle. Vinegar will next be added to make the volcano erupt. Before eruption, students should be away from the table and the teacher should wear goggles for safety when erupting the volcanoes. The chemical reaction is not dangerous, however. Students will be instructed to discuss as a group what happened to cause the volcano to erupt as well as what would have happened to everything that go wet with "lava." The groups should also discuss what the differences are between a volcano before it erupts and afterward. Groups should share their discussion findings with the class in a brief "group share time" to wrap-up this activity.

Lesson Title: News Articles and Historical Eruptions
By Rebecca Dayton

Objectives: Students will write news articles about historical eruptions.
Students will select historical eruptions and identify notable information about them.
Students will read sample new articles from the daily newspaper.
Students will publish their new articles in the class newsletter at the end of the unit.

IGOs:
4.46 identify and use content area vocabulary given a variety of reading materials.
4.49 use the writing process across the curriculum.
4.50 develop various types of writing including, but not limited to, narrative, informative, and persuasive.
4.53 produce a composition with a main idea and specific, relevant details.
4.81 identify appropriate reference sources for specific information.
4.83 identify and use sources of different types of information.
4.101 using a word processor, input types of writing such as paragraphs, stories, letters, and newspaper articles.

Materials: daily newspapers
encyclopedias, informational texts, and websites about volcanic eruptions
computers with word processing capabilities

Procedure/Assessment: In this lesson, students will be given the opportunity to select historical volcanic eruptions and produce news articles about them. By reading sample articles from daily newspapers, students will have models for their own news articles. Once the children have selected specific eruptions, they will consult resource materials in order to gain factual information about these eruptions. The students will move the writing process (prewriting, draft, revising, editing, and publishing) and complete final news articles using word processors. The unit's alternative assessment will consist of a class newsletter; students will have the opportunity to include their articles as part of the newsletter. Further, the students will be assessed on this lesson by the following question that is part of the formal unit test: True or False A news article would contain facts about volcanic eruptions.

Lesson Title: Persuasive Speeches and Volcano Evacuations
By Rebecca Dayton

Objectives: Students will prepare and present persuasive speeches concerning evacuations for volcanic eruptions.
Students will list reasons for why evacuations are important safety procedures for volcanic eruptions.
Students will listen to the reading of a sample evacuation announcement.
Students will brainstorm ideas as to why some people do not follow evacuation guidelines.

IGOs: 4.17 make an oral presentation using appropriate volume, pitch, and rate of speech.
4.50 develop various types of writing including, but not limited to, narrative, informative, and persuasive
4.79 identify purpose of various types of paragraphs.

Materials: sample evacuation announcement

Objectives	Procedures	Assessment
	Introduction	
Students will listen to the reading of the evacuation announcement.	Read the sample evacuation announcement: "Over the past two weeks, Mount Volcano has been showing signs of a coming eruption. Last night's mini-eruption of lava symbolizes the imminent nature of the eruption. Lakeview is currently under a volcano alert, meaning a hazardous volcanic event is expected within a few hours or days. In order to ensure safety of all local citizens, you are being asked to vacate your homes immediately. Please obtain shelter at a safe distance from the	Students attentively listen. Students show visual signs of listening: watching the reader, nodding in agreement, etc.

Students will respond to question prompts. Students will respond to the reading of the evacuation announcement. Students will define persuasive speech.	volcano. Your lives may be dependent on this evacuation." Ask the students: "What would you do if you were in this situation?" "If you would evacuate, what about this announcement encourages you to do so?" Introduce the term persuasive speech. Allow the students to provide explanations of what they believe to be persuasive speech. Present the following definition: "writing that is meant to change a reader's thinking or action" (Kemper, et al., 1996).	Students make connections between personal thoughts and the content of the evacuation announcement. Students give logical responses. Students relate definition to parts of the evacuation announcements or other samples of persuasive speech.
	Development	
Students will connect science and social studies content to the concerns surrounding volcanic eruptions. Students will emphasize with those who need to evacuate due to	Discuss with the students why evacuations occur in the areas surrounding volcanoes that are to soon erupt. Key ideas are the following hazards: blast and projectiles, fires, mud flows, burns, inhalation sicknesses, asphyxia, toxic gases, lava flows, local earthquakes, and tidal waves (CDERA, 2000). Emphasize that staying in the area may result ultimately in fatalities. Discuss with the students why people may be reluctant to evacuate.	Students give multiple reasons for leaving affected areas. Students relate the situation to knowledge learned in the science and social studies aspects of the unit. Students listen to and possibly respond to the comments made by their peers. Students provide logical reasons for not following evacuation

imminent volcanic eruptions.	Key ideas include: scared of losing the home, staying with animals or other possessions that may not be transported, wanting to see actual eruption, and just preferring not to leave.	announcements.
Students will connect the nature of evacuation announcements to the general purpose of persuasive speech.	Connect evacuation announcements to persuasive speech. Say: "Even though the people may not want to leave, they should for their own well-being. To encourage them to evacuate, announcements need to help persuade the residents to leave. The notices need to give real and important reasons for leaving."	Students give sample phrases of persuasive speech, as related to volcanic eruptions.
	Application	
Students will write persuasive speeches that will serve as evacuation announcements.	Allow the students to write persuasive speeches for either historical or fictional volcanic eruptions. The students need to attend to their audience's concerns and to the factual information that exists about the hazards of the eruptions. The students can refer to past research for facts.	Students write at least four sentences: state the subject and give three facts, one directly related to people who may choose not to evacuate.
Students will monitor and revise their persuasive speeches.	Guide a review of the speeches prior to the students' presentations. Ask: "Is your speech appropriate for your	Students evaluate their speeches based on the provided questions. If necessary, students

	audience?" "Did you include the reason for the announcement?" "Have you provided factual reasons in favor of evacuation?" "Did you remember to address those who may choose not to evacuate?" "Do you think your speech might change the mind of someone who would not want to evacuate at first?" Allow the students to revise their speeches if necessary.	revise their speeches so that all of the mentioned requirements are included.
Students will be members of small presentation groups.	Once revisions are complete, have the students divide into groups for four. Within the groups, the students are to present their speeches. Tell the students to speak loud enough for their audience to hear, emphasizing important points. The students also should not speak too rapidly. Within the small groups, the students rate the effectiveness of their peers' speeches. A "I would definitely evacuate now" speech receives four point. A "I am really going to think about leaving" speech receives three points. A "Well, maybe" speech receives two points, and a "I am still going to stay" speech receives one point.	Students are divided into to groups of four or so.
Students will orally present their speeches.		Students speak to their audience at appropriate volume and speed levels.
Students will attentively listen to their peers.		Students show visual signs of listening.
		Students show visual signs of listening: watching the reader, nodding in agreement, giving appropriate and related comments, etc.
Students will evaluate the effectiveness of persuasive speeches.		Students rate the speeches of peers on a scale of one to four points.
Students will review the	Return to a whole class	Students provide reasons

main ideas of the lesson. Students will apply the main ideas to sample work.	setting. Review why evacuations are part of the safety plan for volcano eruptions. Review the definition of persuasive speech. Allow each small group to nominate a representative speech. Use these speeches to mention specific examples of factual information and persuasive wording and/or intent.	for evacuations. Students provide definitions and examples of persuasive speech. Students note specific aspects of speeches that pertain to factual information. Students note specific aspects of speeches that pertain to persuasion.

Formal/Final Assessment: The unit test includes that following test question to partially address the content presented in this lesson: True or False
Persuasive speech informs people of historical events.

Lesson Title: Public Concerns
By Michelle Sisler

Objectives: Students will use critical thinking skills.
Students will use the Internet to research a topic.
Students will write a one-page paper and present the topic to the class.
Students will pick a recent volcanic eruption and will research the total cost of the eruption (property damage, etc)
Students will compare the volcano that they researched with others in the room and a chart comparing the costs will be created.

IGOs: 4.5 probe deeply into natural phenomena by asking and answering questions about the environment (e.g., biomes, weather patterns)
4.26 understand and reason about the use and misuse of statistics in our society. Given certain situations and reported results, identify faulty arguments or misleading representations of data.
4.26 support statements with facts (e.g., found in books, multimedia, Internet)
4.28 collect, organize, display, read, and interpret data from a problem solving situation in line graphs, bar graphs, tally charts, and tables with scale increments of one or greater than one.

Materials: computers, paper, pencils, chalk, black board, graph paper, rulers

Procedures/Assessment: This lesson is intended to make students think about the cost of the destruction that is caused because of volcanic eruptions. It focuses only on the money aspect, not the loss of human life. The students will pick a recent volcanic eruption and will research it using the Internet. The teacher will have to organize the students so that no two students research the same volcanic eruption. The students will then write a paper describing the eruption and its monetary cost. After all of the students have presented their papers to the class, the class will graph all of the expenses to compare the costs of different volcanoes. Students will write a one-page paper in which they will identify and analyze five environmental effects of volcanoes.

Lesson Title: Environmental factors
By Michelle Sisler

Objectives: Students will use the Internet to research volcanoes and the effect that they have on the environment.
Students will write a paper analyzing and explaining five environmental effects of volcanoes.

IGOs: 4.5 probe deeply into natural phenomena by asking and answering questions about the environment (e.g., biomes, weather patterns)
4.26 support statements with facts (e.g., found in books, multimedia, Internet)

Materials: computers, paper, pencils, chalk, black board

Procedure/Assessment: During this lesson the students will examine some environmental concerns that might arise because of volcanic eruptions. The students will use the Internet to research the environmental effects of volcanoes. The students will then write a one-page paper in which they analyze and discuss five environmental concerns related to the eruptions of volcanoes. These papers will be graded for scientific accuracy and adherence to the guidelines for the paper that will be provided by the teacher. Students will write a one-page paper in which they will identify and analyze five environmental effects of volcanoes.

Lesson Title: Preparing Interviews for Professionals in the Field of Volcanoes
By Rebecca Dayton

Objectives: Students will write interview questions for learning more about professions related to volcanoes.
Students will identify professional occupations that dealing directly with volcanoes.
Students will conduct mock and real interviews.
Students will create reports about the interviews.

IGOs: 4.46 identify and use content area vocabulary given a variety of reading material.
4.50 develop various types of writing including, but not limited to, narrative, informative, and persuasive.
4.81 identify appropriate reference sources for specific information.
4.95 using a word processor, create a one or more paragraph document.

Materials: sample interview questions
encyclopedias, informational texts, websites, and career brochures
computers with word processing capabilities

Procedure/Assessment: In this lesson, students will explore both a technique for gaining information and also professions related to volcanoes. After reviewing sample interview questions, students will refer to the resource materials to identify actual careers in the volcano field. Volcanologists, geoscientists, geo-technicians, seismologists, and rescue personnel, are examples of the professions students will want to investigate. Once students select careers, they will write interview questions for learning more about the professions. The students may wish to work in small groups to brainstorm general questions. The students will create interview documents using their word processing skills. After they write their personal interviews, they will select the focus profession of a peer's interview and research that career. Next, the students will conduct mock interviews in order to obtain answers to their interview questions. This assumes that no volcano professions will be available for actual interviews. Finally, the students will write summaries of their interviews and the subsequent findings. The alternative assessment for the unit will be a class newsletter; the students will have the opportunity to include their interviews in the publication. As part of the final unit assessment, the students will answer the following question: _____ is the technique of writing and asking questions in order to learn more about a person and/or a career.

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Lesson Title: Class Newsletter
By Rebecca Dayton

Objectives: Students will create a class newsletter, presenting an overview of the volcano unit.
Students will each select at least one personal contribution to the newsletter.
Students will work cooperatively to present a unified format and overview.
Students will publish their newsletter and distribute it to parents and other interested individuals.

IGOs: 4.46 identify and use content area vocabulary given a variety of reading materials.
4.49 use the writing process across the curriculum.
4.101 using a word processor, input types of writing such as paragraphs, stories, letters, and newspaper articles.

Materials: sample newsletters from local organizations or the school
computers with word processing capabilities and newsletter formats
color printer
scanner or digital camera

Procedure/Assessment: The final Language Arts' lesson will also couple as the alternative assessment. This lesson will serve as a review of the writing process and the other Language Arts' skills addressed in the unit, since the students will be incorporating all of them into the newsletter. The students will first review newsletters created by local organizations or the school community. In order to effectively present the integrated unit, the students will create a class newsletter. The class will first be divided into small groups, each covering a different subject area. Next, the students within these groups will select work samples to include in the newsletter. Each student will have the opportunity to make at least one personal contribution to the newsletter. After the groups have decided on the contents, they will need to select or design a unified format for the newsletter. Members of different small groups will peer edit the contributions of other students. The students will include a class photo and may wish to incorporate other types of illustrations that support the newsletter's content. Once the newsletter is published, it will be distributed to parents and other interested individuals. Rubrics for assessing and evaluating students' participation in the newsletter are included in the alternative assessment section of the unit. As for the final unit test, the students will respond to the following question: To inform others of our volcano unit and to help them learn more about what we did, our class created a _____.

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Formal Assessment

1. In The Volcano Disaster, Warren Spalding is teleported back to the morning of the eruption of which volcano?

   A. Mount St. Helens
   B. Mount Pelee
   C. Mount Rainer
   D. Mount Santorini

2. What is the correct order of the layers of the Earth from the center moving outward?

   A. Core, Crust, Mantle
   B. Mantle, Core, Crust
   C. Crust, Mantle, Core
   D. Core, Mantle, Crust

3. The eruption of Mount Pelee had the highest casualty total of what century?

   A. the twenty-first century
   B. the eighteenth century
   C. the twentieth century
   D. the nineteenth century

4. When did Mount St. Helen's erupt?

   A. January 18, 1923
   B. May 18, 1980
   C. July 4, 1967
   D. October 8, 1975

5. What happens at locations where plates move from side to side bumping up against one another?

   A. Volcanoes
   B. Mountain Building
   C. Earthquakes
   D. Subduction Zones Form

6. _____ is the technique of writing and asking questions in order to learn more about a person.

7. _____ is the term that refers to internal friction or visible "thickness" of a liquid.

8. To inform others of our volcano unit and to help them learn more about what we did, our class created a _____.

9. Most shield volcanoes are found where? _____.

10. Pinatubo erupted in June of _____.

11. True or False Persuasive speech informs people of historical events.

12. True or False Volcanoes appear to have "blown their tops" after an explosion.

13. True or False A news article would contain facts about volcanic eruptions.

14. True or False People should not worry about the effects of volcanoes on the environment.

15. True or False The cost of rebuilding a city that has been destroyed by a volcano never costs over a thousand dollars.

Alternative Assessment

As the alternative assessment for the unit on volcanoes, the students will have the opportunity to create a classroom newsletter. Within this newsletter, the students will present content that directly relates to the actual lessons included in the unit. Samples of student work, pictures of projects, book reviews, interviews, and news articles may all be part of the assessment. Additional information on the alternative assessment is included in the lesson narrative entitled "Class Newsletter." The checklist below is intended to help in the evaluation of the students' participation in and understanding of the volcano unit. If so desired, the checklist can be formulated into an evaluative rubric through the addition of scaled-divisions for each checklist point. The checklist can also be adapted to assess small groups, rather than individual students.

__ The student is a member of a small content-specific group.

"The members of my small group are _____."

Our subject area specialization was _____."

__ The student provides at least one suggestion for the group's part of the newsletter.

"I suggested that my small group _____."

__ The student contributes at least one self-made item to the newsletter:

"I included _____ in the newsletter."

__ The student's contribution demonstrates understanding of the specific content.

"About volcanoes, I know _____."

__ The student edits the contribution of another student who is not in the same small group.

"I edited _____'s contribution, which was _____.

I made ____ suggestions. One suggestion or editing mark I made was

_____."

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__ The student monitors the validity of volcano information included in the newsletter.

"I double-checked that the information about volcanoes and our unit was correct. An example of what I checked is _____

_____."

__ The student distributes at least one copy of the newsletter.

"I gave a copy of the newsletter to _____."

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APPENDIX

Plate Boundaries Worksheet

Draw a picture of each plate movement described below. Write beside each drawing a more detailed description and what occurs at these areas of plate boundaries.

Plates move apart

Plates move together

Plates move side to side against one another

Viscosity Data Sheet

Define "Viscosity" Below:

Viscosity –

Please fill out the following data table with results from your experiment:

Liquids to Test	Time Results
Honey	
Maple Syrup	
Chocolate Syrup	
Dishwashing Detergent	
Shampoo	